

A common-path, multi-channel heterodyne laser interferometer for sub-nanometer surface metrology

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ABSTRACT

A multi-channel **heterodyne** laser interferometer is proposed for the JPL Thermo-Opto-Mechanical Testbed, which requires the measurement of optical surface deformations at the sub-nanometer level. This proposed interferometer employs a common-path configuration and heterodyne detection, by which fringe errors due to laser frequency fluctuations and optical path variations due to vibration can be reduced. By measuring the heterodyne signal phase between a subaperture (a pixel) and the full aperture (average) with a 2-D detector array, the surface height can be reconstructed and surface deformation can be measured by comparing consecutive measurement results. Detection of subnanometer level surface deformation is achieved using high precision digital phase discriminator electronics and athermalized opto-mechanical systems. In this paper, we will report the interferometer design and some preliminary results. Other potential applications of this common-path multi-channel heterodyne interferometry technique will also be discussed.

Key words: heterodyne interferometry, interferometric metrology, nano-technology.